5.3: Radio Astronomy

National Radio Astronomy Observatory Very Large Array Telescope (VLA).

https:/commons.wikimedia.org/wiki/File:National_Radio_Astronomy_Observatory_Very_Large_Array_Telescope_(VLA)_-_panoramio_(1).jpg;

In 1930, Karl Jansky, an engineer working for Bell Labs, built the first radio telescope. Jansky used his invention to study radio emissions from the Milky Way Galaxy. His original telescope had wheels taken from a Model T Ford to make it mobile.

In many ways, a radio telescope operates on a similar principle as a reflecting telescope. It uses a curved dish to focus radio waves on to central point where a radio wave detector can convert those radio waves into an electronic signal. However, because of the longer wave lengths, radio dishes are more tolerant of imperfections and do not have to be polished to near perfection. Radio astronomy has a few advantages over optical telescopes. For example, radio telescopes can operate day and night, rain or shine. Clouds, rain, and snow do not interfere with the seeing of a radio telescope the way they do with optical telescopes. Observations on a different set of wavelengths also enables us to see features that would otherwise be invisible. Many objects emit radio signals but either do not emit visible light or their light is scattered by interstellar clouds of dust.

The longer wavelengths, however, do result in lower quality in resolution combined to visible light. This can be overcome by using **interferometry**, which involves using multiple radio telescopes examining the same signals. By combing the information from several widely separated radio telescopes, scientists can achieve a resolution equal to that of a telescope with a diameter equal to the largest separation between two dishes. Interferometry works by preserving the phase difference between the waves based on the separation of two or more dishes. This technique can achieve resolution close to that of optical telescopes. We can perform interferometry using optical telescopes, but the shorter wavelengths make it more difficult.

ALMA: The Atacama Large Millimeter/Submillimeter Array uses multiple radio dishes to improve resolution through interferometry.

https:/commons.wikimedia.org/wiki/File:ALMA_-_Antennas_in_compact_configuration.jpg;